

What is claimed is:

5 1. A tissue invasive photonic system, comprising:
a photonic lead having a proximal end and a distal end;
a light source, in the proximal end of said photonic lead, to produce a
first light having a first wavelength and a second light having a second
wavelength;
10 a wave-guide between the proximal end and distal end of said
photonic lead;
a radiation scattering medium at the distal end of the photonic lead to
receive radiation from said wave-guide;
a plurality of power sensors to receive scattered radiation from said
15 radiation scattering medium and convert the received scattered radiation into
electrical energy;
a bio-sensor, in the distal end of said photonic lead, to sense
characteristics of a predetermined tissue region; and
a distal emitter, in the distal end of said photonic lead and responsive
20 to said bio-sensor, to emit a second light having a second wavelength to
proximal end of said photonic lead such that a characteristic of the second
light is modulated to encode the sensed characteristics of the predetermined
tissue region.

25 2. The tissue invasive photonic system as claimed in claim 1, wherein
said power sensors are alternately mounted circumferentially along a
periphery of said radiation scattering medium.

3. The tissue invasive photonic system as claimed in claim 1, wherein said power sensors are electrically connected in series.

5 4. The tissue invasive photonic system as claimed in claim 1, wherein said radiation scattering medium has a decreasing radiation transmission rate along an axis of said radiation scattering medium.

10 5. The tissue invasive photonic system as claimed in claim 4, wherein said power sensors are electrically connected in series with consecutive sensors in an electrical circuit placed further along the axial direction of said radiation scattering medium.

15 6. The tissue invasive photonic system as claimed in claim 1, wherein said power sensors vary in size along an axis of said radiation scattering medium.

20 7. The tissue invasive photonic system as claimed in claim 6, wherein said power sensors increase in size along the axis of said radiation scattering medium towards a distal end of said radiation scattering medium.

8. The tissue invasive photonic system as claimed in claim 1, further comprising:

25 a proximal sensor, in the proximal end of said photonic lead, to convert the modulated second light into electrical energy.

9. The tissue invasive photonic system as claimed in claim 8, further comprising:

5 a transmitter, in the proximal end of said photonic lead and operatively connected to said proximal sensor, to transmit, in response the electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

10 10. The tissue invasive photonic system as claimed in claim 1, wherein said distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

15 11. The tissue invasive photonic system as claimed in claim 1, wherein said distal emitter modulating the second light to create light having differing intensities over a period of time.

20 12. The tissue invasive photonic system as claimed in claim 1, further comprising a beam splitter to direct the second light to said wave-guide and to direct said first light to said plurality of power sensors.

25 13. The tissue invasive photonic system as claimed in claim 1, wherein said distal emitter is a transparent distal emitter transparent to the first light and producing the second light having the second wavelength.

14. The tissue invasive photonic system as claimed in claim 13,
wherein said transparent distal emitter modulating the second light to create
pulses of light having equal intensity and periods of no light, the periods of
no light differing in time in response to the sensed characteristics of the
predetermined tissue region.

15. The tissue invasive photonic system as claimed in claim 13,
wherein said transparent distal emitter modulating the second light to create
light having differing intensities over a period of time.

16. The tissue invasive photonic system as claimed in claim 13,
wherein said transparent distal emitter is an organic light emitting diode.

17. A tissue invasive photonic system, comprising:
a photonic lead having a proximal end and a distal end;
a light source, in the proximal end of said photonic lead, to produce a
first light having a first wavelength and a second light having a second
wavelength;

a first wave-guide between the proximal end and distal end of said
photonic lead;

a second wave-guide, having a plurality of power beam splitters
therein at the distal end of the photonic lead to receive and reflect the first
light from said first wave-guide;

a plurality of power sensors to receive the first light from said power
beam splitters in said second wave-guide and convert the received first light
into electrical energy;

a bio-sensor, in the distal end of said photonic lead, to sense characteristics of a predetermined tissue region; and

a distal emitter, in the distal end of said photonic lead and responsive to said bio-sensor, to emit a second light having a second wavelength to proximal end of said photonic lead such that a characteristic of the second light is modulated to encode the sensed characteristics of the predetermined tissue region.

18. The tissue invasive photonic system as claimed in claim 17, wherein said power sensors are electrically connected in series.

19. The tissue invasive photonic system as claimed in claim 17, wherein said power beam splitters have decreasing radiation transmission rates along an axis of said second wave-guide.

20. The tissue invasive photonic system as claimed in claim 17, further comprising:

a proximal sensor, in the proximal end of said photonic lead, to convert the modulated second light into electrical energy.

21. The tissue invasive photonic system as claimed in claim 17, further comprising:

a transmitter, in the proximal end of said photonic lead and operatively connected to said proximal sensor, to transmit, in response the electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

22. The tissue invasive photonic system as claimed in claim 17,
wherein said distal emitter modulating the second light to create pulses of
light having equal intensity and periods of no light, the periods of no light
5 differing in time in response to the sensed characteristics of the
predetermined tissue region.

23. The tissue invasive photonic system as claimed in claim 17,
wherein said distal emitter modulating the second light to create light having
10 differing intensities over a period of time.

24. The tissue invasive photonic system as claimed in claim 17,
further comprising a beam splitter to direct the second light to said wave-
guide and to direct said first light to said plurality of power sensors.

25. The tissue invasive photonic system as claimed in claim 17,
wherein said distal emitter is a transparent distal emitter transparent to the
first light and producing the second light having the second wavelength.

26. The tissue invasive photonic system as claimed in claim 25,
wherein said transparent distal emitter modulating the second light to create
pulses of light having equal intensity and periods of no light, the periods of
no light differing in time in response to the sensed characteristics of the
predetermined tissue region.

27. The tissue invasive photonic system as claimed in claim 25, wherein said transparent distal emitter modulating the second light to create light having differing intensities over a period of time.

5 28. The tissue invasive photonic system as claimed in claim 25, wherein said transparent distal emitter is an organic light emitting diode.

29. An tissue invasive photonic system, comprising:
a photonic lead having a proximal end and a distal end;
10 a light source, in the proximal end of said photonic lead, to produce a first light having a first wavelength and a second light having a second wavelength;
a wave-guide between the proximal end and distal end of said photonic lead;
15 a plurality of power sensors to receive the first light from said wave-guide and convert the received first light into electrical energy, each power sensor absorbing a fraction of the received first light;
a bio-sensor, in the distal end of said photonic lead, to sense characteristics of a predetermined tissue region; and
20 a distal emitter, in the distal end of said photonic lead and responsive to said bio-sensor, to emit a second light having a second wavelength to proximal end of said photonic lead such that a characteristic of the second light is modulated to encode the sensed characteristics of the predetermined tissue region.

30. The tissue invasive photonic system as claimed in claim 29,
wherein said power sensors are electrically connected in series.

5 31. The tissue invasive photonic system as claimed in claim 29,
wherein said power sensors are stacked.

32. The tissue invasive photonic system as claimed in claim 31,
wherein radiation captured is increased with increasing distance into the
sensor stack.

10 33. The tissue invasive photonic system as claimed in claim 29,
wherein said power sensors are concentric.

15 34. The tissue invasive photonic system as claimed in claim 33,
further comprising a reflective grating to disperse radiation uniformly over a
surface of said concentric sensors.

35. The tissue invasive photonic system as claimed in claim 29,
further comprising:

20 a proximal sensor, in the proximal end of said photonic lead, to
convert the modulated second light into electrical energy.

36. The tissue invasive photonic system as claimed in claim 35,
further comprising:

25 a transmitter, in the proximal end of said photonic lead and
operatively connected to said proximal sensor, to transmit, in response the

electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

37. The tissue invasive photonic system as claimed in claim 29,
5 wherein said distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

38. The tissue invasive photonic system as claimed in claim 29,
10 wherein said distal emitter modulating the second light to create light having differing intensities over a period of time.

39. The tissue invasive photonic system as claimed in claim 29,
15 further comprising a beam splitter to direct the second light to said waveguide and to direct said first light to said plurality of power sensors.

40. The tissue invasive photonic system as claimed in claim 29,
20 wherein said distal emitter is a transparent distal emitter transparent to the first light and producing the second light having the second wavelength.

41. The tissue invasive photonic system as claimed in claim 40,
25 wherein said transparent distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

42. The tissue invasive photonic system as claimed in claim 40, wherein said transparent distal emitter modulating the second light to create light having differing intensities over a period of time.

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43. The tissue invasive photonic system as claimed in claim 40, wherein said transparent distal emitter is an organic light emitting diode.

44. An tissue invasive photonic system, comprising:
a photonic lead having a proximal end and a distal end;
a light source, in the proximal end of said photonic lead, to produce a first light having a first wavelength and a second light having a second wavelength;

a wave-guide between the proximal end and distal end of said photonic lead;

a bio-sensor, in the distal end of said photonic lead, to sense characteristics of a predetermined tissue region;

a distal emitter, in the distal end of said photonic lead and responsive to said bio-sensor, to emit a second light having a second wavelength to proximal end of said photonic lead such that a characteristic of the second light is modulated to encode the sensed characteristics of the predetermined tissue region;

a power sensor to receive the first light from said wave-guide and convert the received first light into electrical energy; and

a plurality of switchable capacitors operatively connected to an output of said power sensor.

45. The tissue invasive photonic system as claimed in claim 44,
further comprising a control circuit operatively connected between said
power sensor and said plurality of switchable capacitors to control charging,
switching, and discharging of said capacitors.

46. The tissue invasive photonic system as claimed in claim 44,
wherein said control circuit switching said plurality of switchable capacitors
into a series electrical circuit so that the voltage output of each capacitor is
additive.

47. The tissue invasive photonic system as claimed in claim 45,
wherein said control circuit switching said plurality of switchable capacitors
into a parallel electrical circuit to enable simultaneous charging of said
capacitors.

48. The tissue invasive photonic system as claimed in claim 44,
wherein each switchable capacitor has a variable capacitance.

49. The tissue invasive photonic system as claimed in claim 45,
wherein said control circuit switching said plurality of switchable capacitors
to enable sequential charging of said capacitors with a pre-determined pulse
intensity and duration.

50. The tissue invasive photonic system as claimed in claim 44,
further comprising:

a proximal sensor, in the proximal end of said photonic lead, to convert the modulated second light into electrical energy.

5 51. The tissue invasive photonic system as claimed in claim 50, further comprising:

a transmitter, in the proximal end of said photonic lead and operatively connected to said proximal sensor, to transmit, in response the electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

10 52. The tissue invasive photonic system as claimed in claim 44, wherein said distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the
15 predetermined tissue region.

53. The tissue invasive photonic system as claimed in claim 44, wherein said distal emitter modulating the second light to create light having differing intensities over a period of time.

20 54. The tissue invasive photonic system as claimed in claim 44, further comprising a beam splitter to direct the second light to said waveguide and to direct said first light to said plurality of power sensors.

55. The tissue invasive photonic system as claimed in claim 44, wherein said distal emitter is a transparent distal emitter transparent to the first light and producing the second light having the second wavelength.

5 56. The tissue invasive photonic system as claimed in claim 55, wherein said transparent distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

10 57. The tissue invasive photonic system as claimed in claim 55, wherein said transparent distal emitter modulating the second light to create light having differing intensities over a period of time.

15 58. The tissue invasive photonic system as claimed in claim 55, wherein said transparent distal emitter is an organic light emitting diode.